

### **REMARKS**

Applicant respectfully requests reconsideration. Claims 1-18 and 31-38 were previously pending in this application. Claims 1-11, 17, 31, 32 and 34 have been amended. New claims 39-42 have been added. As a result, claims 1-18 and 31-42 are pending for examination with claims 1, 31 and 39 being independent claims. No new matter has been added.

#### **Rejections Under 35 U.S.C. §103**

The Examiner rejected claims 1, 5-7, and 12 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,224,217 to Zangenehpour ("Zangenehpour") in view of "Applicant's Admitted Prior Art" ("AAPA"). Applicants respectfully submit that even if combined, the references would not teach all limitations of any of the claims and must be withdrawn.

Briefly, the present application describes a cache with a priority-based replacement policy. When a new item is to be stored in the cache, a priority is obtained for the new item based on its address in computer system memory. As described in the application, this approach allows priorities to be based on the priorities of processes that have been assigned blocks of system memory. As a result, priorities used for making cache replacement decisions can be set based on the priority of the processes using the items in the cache.

The claims are rejected based on a combination of Zangenehpour and the background of the present application (called "AAPA" in the Office Action). However, these references do not teach replacement based on the address of an item in computer system memory. Zangenehpour relates to a conventional Least Recently Used (LRU) replacement policy. As understood, the reference asserts that it discloses an improved structure to implement an LRU policy (col. 2, lines 45-48). In an LRU policy, when a new item is to be cached, the new item replaces an item in the cache that has been in the cache for the longest time without having been used. Zangenehpour asserts that such a cache was conventionally implemented by organizing blocks of memory in the cache in a chain, from most recently used to least frequently used, which required reordering the blocks as the items stored in the blocks were accessed. The improvement suggested to this approach is to create a "priority tag" for each block of memory. Each priority tag is a measure of how recently a corresponding

block was accessed (col. 4, lines 7-10). Rather than rearrange blocks in memory when the cache is accessed, Zangenehpour teaches changing the numbers for the priority tags.

The Office Action acknowledges that Zangenehpour does not implement a replacement policy based on addresses in the address space of the computer system memory. Rather, the Office Action cites the background of the present application (called "AAPA" in the Office Action) as teaching that an address space separate from the addresses of the cache locations is well known. Applicants respectfully disagree that this teaching is sufficient to yield the claimed invention.

The admitted prior art does not use an address in address space of system memory as part of a cache replacement policy. Thus, there is no basis for the assertion that the combination Zangenehpour and AAPA teaches the use of an address space in system memory in a cache replacement policy as claimed.

To the contrary, Zangenehpour itself demonstrates the AAPA does not teach the use of addresses in computer system memory in a cache replacement policy. Zangenehpour already shows memory separate from the cache. That memory includes storage devices 12-15 and main memory 16. Addresses for these locations are not used in the replacement policy of Zangenehpour. Only the values assigned to tags in the cache that identify the least recently used memory block are used to select a block of memory for replacement (see, FIG. 2 and col. 4, lines 5-18).

Even if AAPA were combined with Zangenehpour, the result would *not* be as claimed. Though the separate memories of Zangenehpour may have a separate address space as taught by AAPA, those addresses would *not* be used in the cache replacement policy. AAPA provides no reason to modify the cache replacement policy of Zangenehpour. To the contrary, the modification of Zangenehpour hypothesized in the Office Action destroys the express teachings of Zangenehpour of an improved way to implement a cache replacement policy. Thus, even if the references were combined, the cache of Zangenehpour would continue to operate on its LRU policy without regard to the addresses in memory separate from the cache.

This combination does not meet all limitations of claim 1. For example, it would not meet the limitation requiring: "associating a priority with the new item based on the address in the address space." The priority of the new item in the LRU policy of Zangenehpour is always the highest priority and is not based on the address in the address space, as claimed. There is nothing in AAPA that teaches the claimed use of the address in the address space of computer system memory.

The claim further recites how this priority is used. Because no such priority is used in the combination, it follows that the combination also does not meet the limitations of the claim that relate to use of the priority. For example, the combination would also not meet the limitation requiring: "selecting a memory location in the cache based in part on priority indicators of the plurality of memory locations in the cache relative to the priority of the new item." In the context of the claim, "the priority" relates to the priority associated with the new item based on the address in the address space. Zangenehpour clearly describes that when a new item is stored, a location is selected only based on the tag values for the locations in the cache so that the lowest valued location is selected. No part of this selection is based on the address in the address space of the computer system memory.

Likewise, the combination does not meet the limitation: "associating the priority of the new item with the selected memory location in the cache." Zangenehpour clearly describes that when a new item is stored, the tag for the location in which it is stored is changed from the lowest value to the highest value and all other tags are decremented by one (col. 4, lines 48-58). A priority is not associated with a cache location using the priority assigned based on an address in computer system memory.

Accordingly, withdrawal of this rejection is respectfully requested.

The Examiner rejected claims 31-35, 37 and 38, including independent claim 31, under 35 U.S.C. §103(a) as being unpatentable over Zangenehpour and AAPA, and further in view of Abe.

For reasons that should be apparent from the discussion of Zangenehpour and AAPA in connection with claim 1, even if the references were combined, they would not meet the limitations of independent claim 31. The combination would not have a replacement policy that uses "a plurality of blocks of addresses in the address space of the computer system and a priority for each of the plurality of blocks of memory." Rather, the combination would have a replacement policy operating on tags that identify the least recently used cache location.

As understood, Abe is not cited to cure this deficiency of the combination of Zangenehpour and AAPA. Rather, Abe is cited only as teaching a data table. Even if true, when combined with Zangenehpour and AAPA, the combination would still only teach a data table storing the values identifying the least recently used locations as in Zangenehpour. There would be no "data table to

identify a plurality of blocks of addresses in the address space of the computer system and a priority for each of the plurality of blocks of memory,” as claimed.

It follows that other limitations of claim 31 also would not be met. For example, the combination would not meet the limitation: “obtaining from the data table a priority for a block of the plurality of blocks of addresses in the address space of the computer system memory containing the address of the item.” The combination also would not meet the limitation: “a location of the plurality of locations selected based on a relative priority of the priority obtained for the item and the priorities of the plurality of locations.” In the context of the claim, “the priority” refers back to the value obtained from the data table holding priorities for blocks of addresses in the address space of the computer system. The references, even if combined, would not meet this limitation.

Accordingly, withdrawal of this rejection is respectfully requested.

#### General Comments on Dependent Claims

The rejections of dependent claims 2-18 and 32-42 are all premised on the cited references meet all limitation of either independent claim 1 or claim 31. For reasons that are described above, the references, even if combined, would not teach all limitations of either of these claims. Thus, the dependent claims should be allowed for the same reasons as the independent claims from which they depend.

While Applicants do not necessarily concur with the interpretation of the claims or references used in rejecting these dependent claims, Applicants believe that these claims are now in condition for allowance and it is unnecessary to comment individually on these claims. Though, Applicants reserve the right to do so later, if necessary.

Also, though these claims are allowable at least based on their dependency, the dependent claims also recite limitations that further distinguish over the references. It is also unnecessary to comment individually on these additional limitations. Though, Applicants reserve the right to do so later, if necessary.

#### New Claims 39-42

New claims 39-42 are also in condition for allowance. These claims recite a method of operating a cache that is supported by the specification and is not shown or suggested in the references, whether considered alone or in combination.

For example, independent claim 39 recites: “a data table to identify a plurality of blocks of addresses in the address space of the computer system memory and a priority for each of the plurality of blocks of memory.” A priority obtained from this data table is also recited: “obtaining from the data table a priority for a block of the plurality of blocks of addresses in the address space of the computer system memory containing the address of the new item, the obtained priority being a priority of the new item.” For reasons that should be apparent from the discussion of the references in conjunction with claim 31, the references do not meet these limitations.

Moreover, the claim recites separate “priority-based” and “usage-based” replacement policies. Support for these limitations may be found, for example, in FIG. 4 (see elements 432 and 434) and the accompanying text. As described above in connection with the discussion of the references in connection with claim 1, the references, even if combined, do not teach a “priority-based” replacement policy based on “the priority.” In this claim, “the priority” refers to a priority for a new item obtained from a data table that has priorities for each of a plurality of blocks in an address space of a computer system memory. No such step is performed in the references, even if combined.

Moreover, Zangenehpour only teaches one replacement policy. Even if modified by combination with other references, there would not be two replacement policies, as claimed.

Thus, there are multiple reasons that claim 39 distinguishes over the cited references and should be allowed.

Claims 40-42 depend from claim 39 and should be allowed at least based on their dependency on claim 39.

### **CONCLUSION**

A Notice of Allowance is respectfully requested. The Examiner is requested to call the undersigned at the telephone number listed below if this communication does not place the case in condition for allowance.

If this response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicant hereby requests any necessary extension of time. If there is a fee occasioned by this response, including an extension fee, the Director is hereby authorized to charge any deficiency or credit any overpayment in the fees filed, asserted to be filed or which should have been filed herewith to our Deposit Account No. 23/2825, under Docket No. A0312.70518US00.

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Respectfully submitted,

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